Joint Sponsored Research Program

Implementation by

American Technology Initiative

- Progress Report -

Presented to

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Associate Administrator
Office of Aeronautics, Exploration and Technology
National Aeronautics and Space Administration

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Chronology:

- 1984 - 1987: Researched innovative mechanisms for conducting joint sponsored research under Space Act
- 1988 - 1989: Prototype projects explored and implemented to demonstrate feasibility of mechanism
- 1989 : Requested delegation of authority (thru OAST)
- 1989 : Briefed AAs and Center Directors, receiving support for the Joint Sponsored Research Program
- 1989(10/1) : AmTech formed to provide institutional and organizational setting for efficient facilitation and implementation of JSR Program
- 1989(12/21): First briefing for Mr. Aldrich: JSR Program/AmTech Concept
- 1990(5/17) : Received conditional go-ahead on initial 2-3 projects from Mr. Aldrich
- 1991(2/5) : Second briefing for Mr. Aldrich: Progress Report of 1990 JSR/AmTech activities

SCOPE OF 1990 ACTIVITIES

Conduct JSR/AmTech Efforts in Accordance with:

- *Conditional* NASA Authorization
  - * Demonstrate feasibility of JSR program
    - Identify strategic R&D programs/technology areas ideally suited to private sector participation
    - Implement 2 - 3 prototype JSR projects
  - * Assess benefits and potential long-term value of JSR program to NASA
- AmTech Mission and Charter
  - * Operate as non-profit research organization dedicated to facilitation of public-private R&D collaboration through research and implementation
  - * Focus on R&D/technology exchange and leveraging of resources to increase R&D efficiencies and economic benefits to the nation
  - * Act to enhance the value and successful implementation of collaborative efforts through "win-win-win-win" proposition

DISCUSSION ITEMS

1. What is the JSR program?

2. How is AmTech implementing the JSR program?

3. What are the accomplishments of the JSR/AmTech program?

4. What are the benefits of the JSR program to NASA?

5. What is the role of AmTech?

6. What are the next steps necessary to realize the full value of the JSR/AmTech program?

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The Joint Sponsored Research Program

- Applies full authority of the Space Act to form jointly sponsored research agreements with the private sector
- Leverages existing mission essential R&D resources, including two-way technology exchanges
- Focuses on sharing R&D rewards in 3-5 year technology development efforts with private sector
- Achieves research efficiencies and accelerated transfer and commercialization of technology

The JSR Program Provides Research Managers with an Effective Methodology for Developing & Implementing Joint R&D Projects

Identification of Joint Research Opportunities	Methodical review of R&D programs and projects to identify opportunities for joint research with private sector
Joint Research Alternatives	Render advice on different NASA methods available to form joint research efforts
Industry Research	Provide information on research efforts and capabilities available in industry, for possible joint efforts
Identify Partners	Utilize network of databases and research contacts to target research partners
Project Development & Implementation	Provide expertise in preparing and monitoring research agreements

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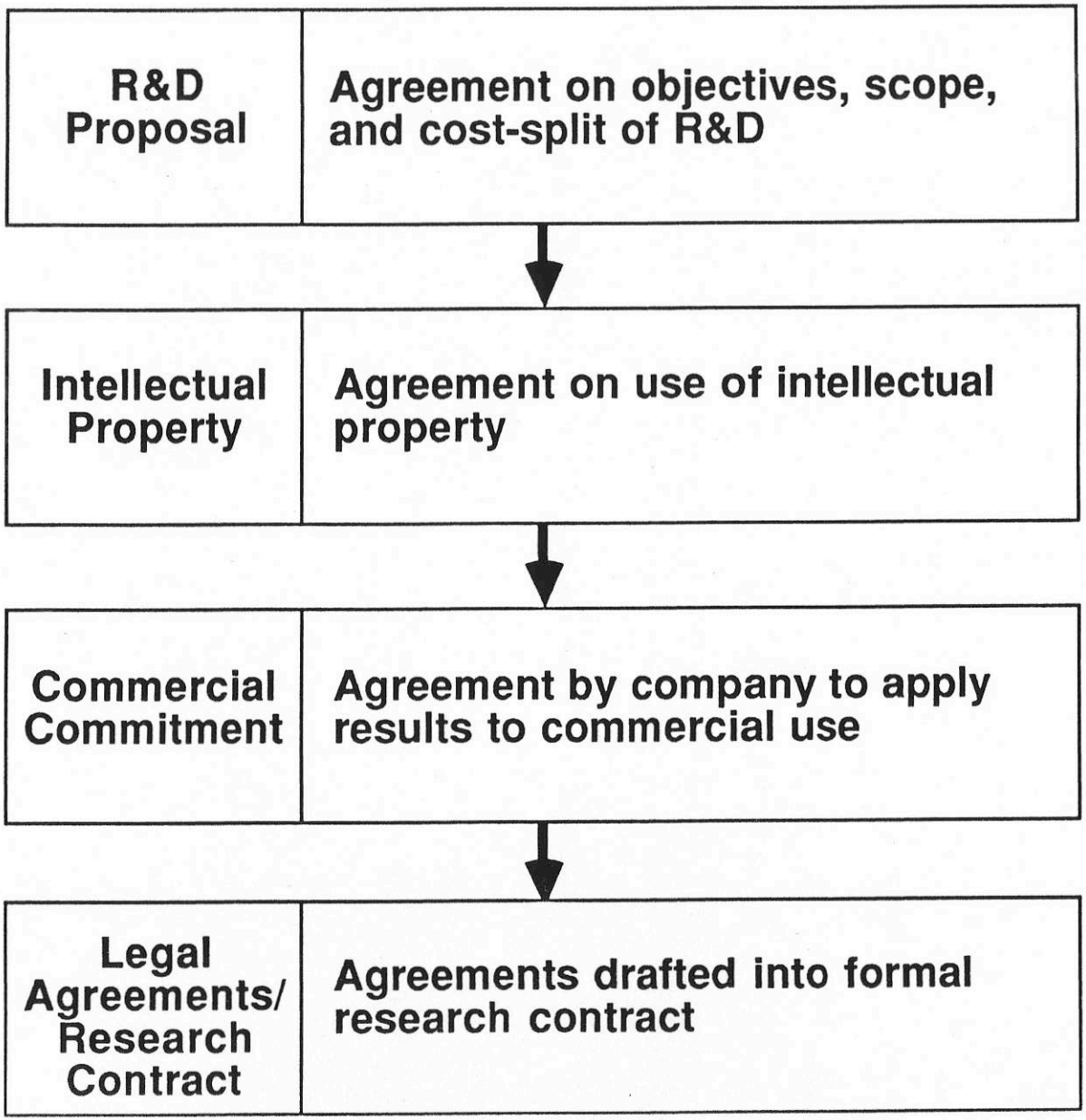
Project Development is Carried Out in A Four Step Process



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Accomplishments Cover the Following:

I. Identification of Strategic R&D Technologies

II. Implementation of Prototype Projects

III. Projects Under Development

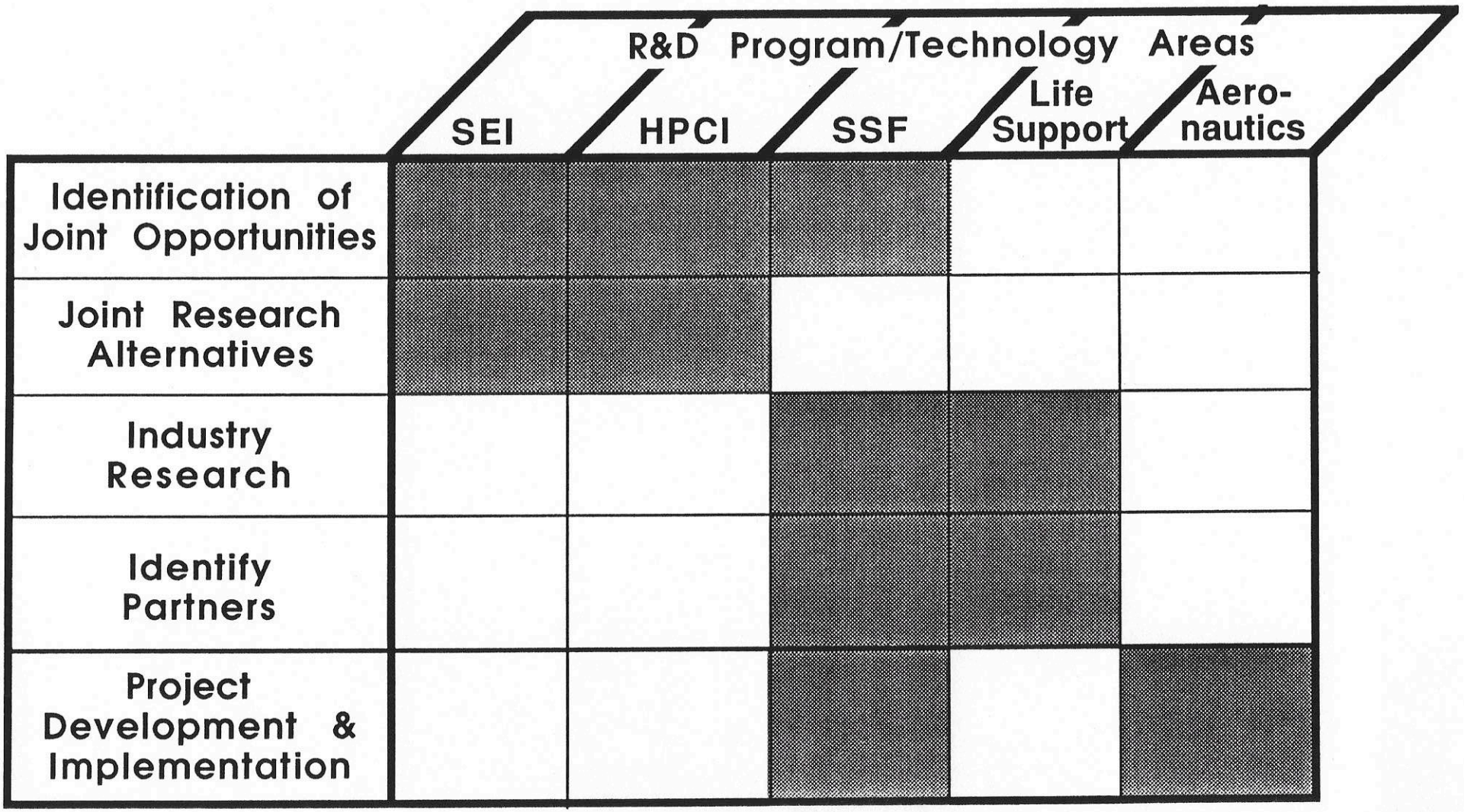
IV. Infrastructure Development

I. Strategic R&D Programs/Technology Areas

Established working relationships with five HQ programs

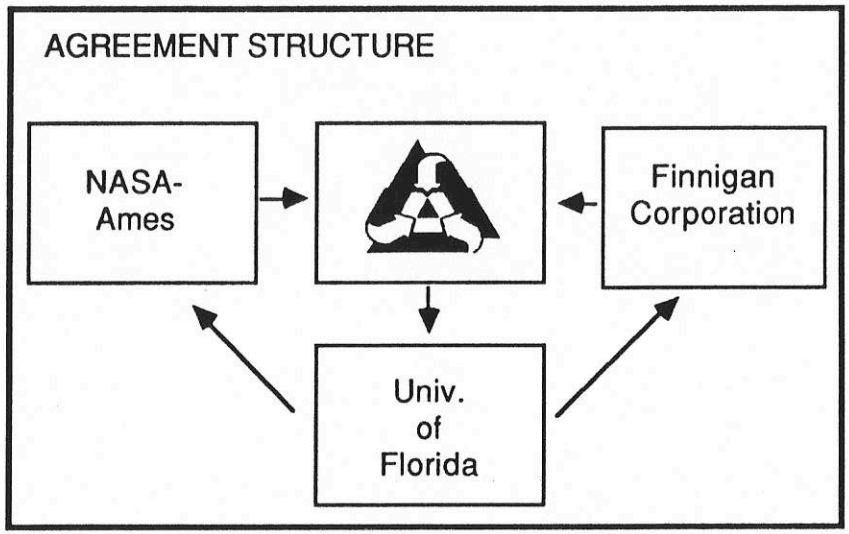
- **SEI (Craig/Mankins/Reeves)**
- **HPCI (Holcomb/Smith/DARPA)**
- **SSF (Huckins/Swietek/Barquinero)**
- **Life Support-Physical/Chemical (Evanich)**
- **Aeronautics (Williams/Hessenius)**

Each R&D Program Manager is Using Different JSR/AmTech Capabilities



II. Implementation of Prototype Projects

1. ***AmTech 8801 (9/88 - 12/90):*** ***Demonstrate the feasibility of a mass spectrometer-based intelligent systems manager for monitoring the life support system and chemical producing experiments during space exploration***



RESOURCE CONTRIBUTIONS

	Cash		In-Kind
NASA	$359,163	+	Consulting
Univ.	$ 94,500	+	Professor and graduate student time, Labs
Finnigan	$175,000	+	Consulting, Labs, Equipment

1. AmTech 8801 (cont'd):

PRIOR DEVELOPED TECHNOLOGY CONTRIBUTED

NASA	1 Software Program (expert system reasoning code)
UNIV.	Source code for operation of the Mass Spectrometer
FINNIGAN	1 Software Program (for data acquisition & analysis)

ROLES

NASA	Developed AI/expert system software for instrument control
UNIV.	Expanded sensitivity and selectivity of Ion Trap Mass Spectrometer providing extremely rapid detection of chemical components, even in complex mixtures
FINNIGAN	Assisted in expanding analytical capability of the Ion Trap Mass Spectrometer and in automating the screening/confirmation protocol

1. AmTech 8801 (cont'd):

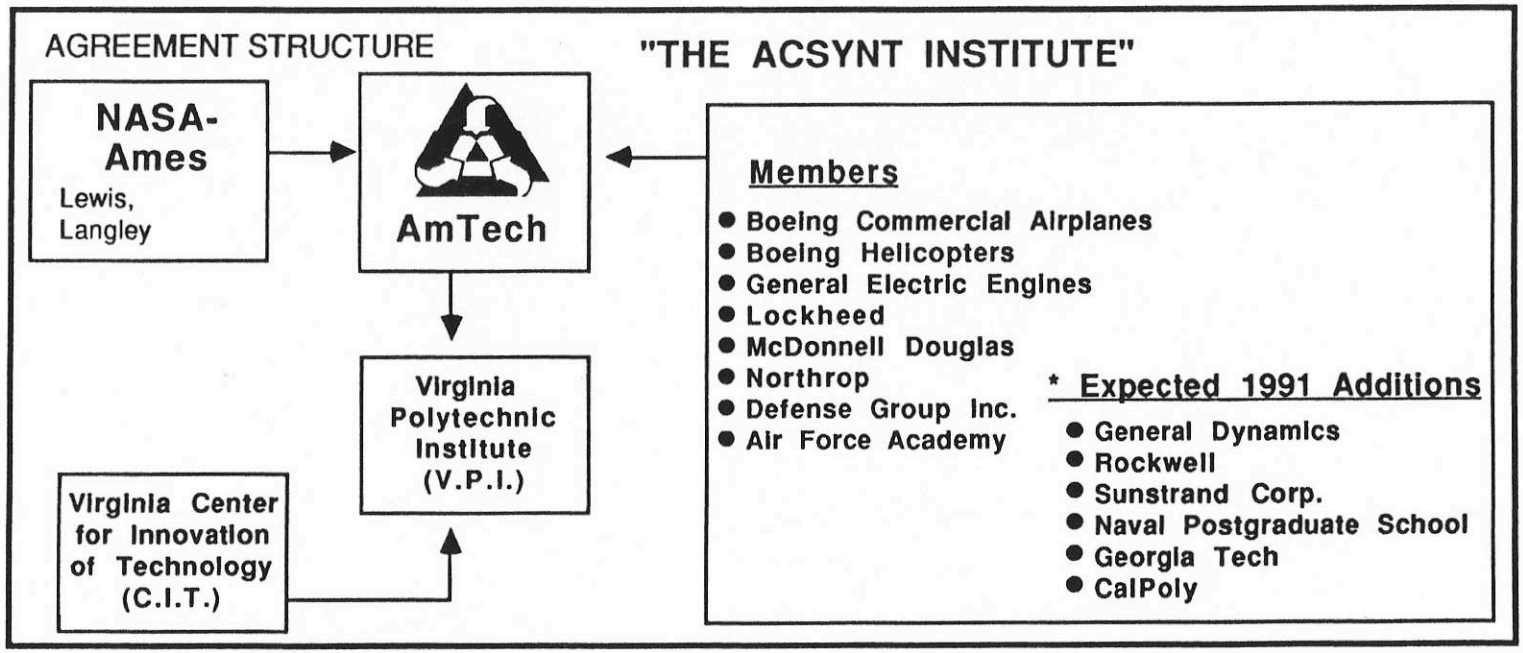
RESEARCH AND DEVELOPMENT RESULTS

	No.	Source
Patents	4	University/Finnigan joint inventions
Software	2	(1) NASA; (2) University/Finnigan joint development
R&D Reports	8	University
Demonstration	1	NASA/University/Finnigan joint demonstration at KSC

BENEFITS TO NASA

R&D	(1) Significant and rapid development of life support technology could not have been achieved without collaboration (2) Feasibility of technology for NASA application demonstrated in only two years
Dollars Leveraged	NASA gained $269,500 worth of paid research (NOT counting the value of prior developed technology Finnigan shared with NASA or in-kind support from Finnigan and University)
Intellectual Property Gained	(1) NASA gained use of 4 patents and 2 software programs (2) Additionally, Finnigan gave NASA permanent and free use of software code developed by Finnigan at private expense
Successful Tech Transfer & Commercialization	(1) Technology moved into/out of NASA (2) "Time-to-Commercialization:" an unprecedented 2 years (average is 10 years)

2. *AmTech 8901 (1/90 - 12/95):* *Develop software for the conceptual design of aircraft providing interactive analytical and three-dimensional graphical capability*



RESOURCE CONTRIBUTIONS

	Cash (annual)		In-Kind (annual)
NASA	$100,000	+	Two (2) Full-Time programmer/analysts
V.P.I. C.I.T.	$84,000 $47,500	+	1 yr. professor & grad. students time; labs & equipment
Members 1990 1991	 $167,500 $287,000 (est.)	+	In 1991, each company is dedicating a person to testing & development of code

2. AmTech 8901 (cont'd):

PRIOR DEVELOPED TECHNOLOGY

NASA	Analysis modules on geometry, trajectory, aerodynamics, propulsion, weights, stability, and take-off
UNIV.	PHIGS-based graphics software
MEMBERS	In 1991: • GE: engine platform with thermodynamic cycle analysis • LOCKHEED: carpet plotting techniques; code for 4.5 and 6 digit airfoil analysis • McDONNELL DOUGLAS: library of cockpits & engines; user's manual of landing code • NORTHROP: weights routines • BOEING COMMERCIAL: landing gear designs; line-by-line documentation of ACSYNT code

ROLES

NASA	Develop code to perform analysis and design of aircraft
UNIV.	Develop code integrating conceptual analysis with graphic display
MEMBERS	Test code releases; provide feedback on code architecture and performance

2. AmTech 8901 (cont'd):

RESEARCH AND DEVELOPMENT RESULTS (to date)

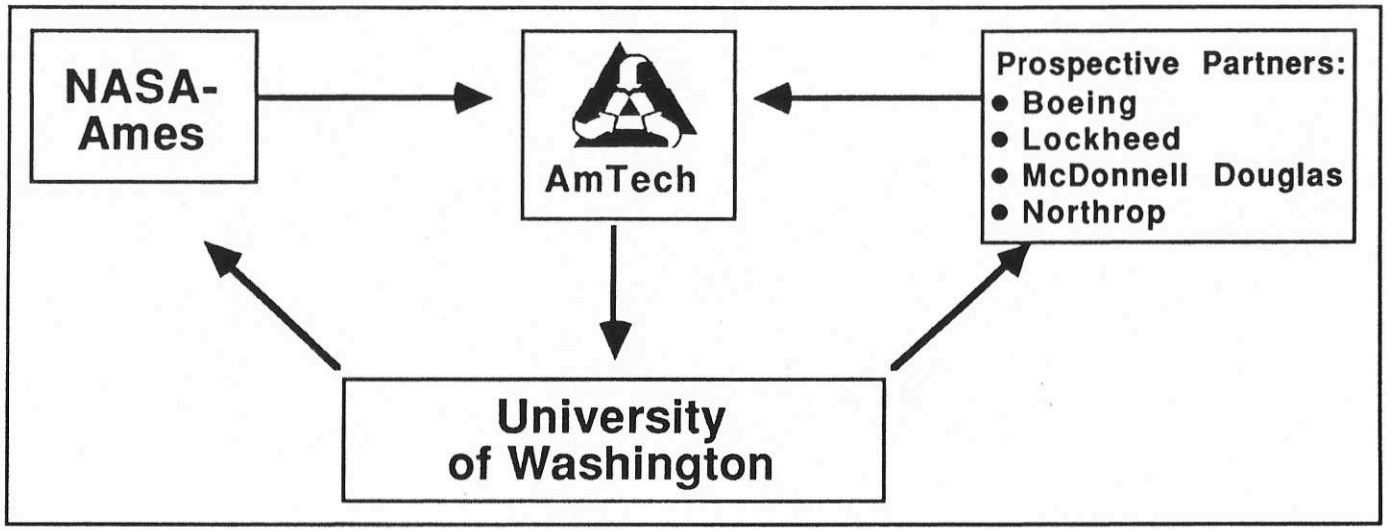
- Addition of software modules covering sonic booms, link to Harris Wave Drag and supersonic VLM codes, economics, take-off noise
- Industry members are calling ACSYNT the emerging standard for the conceptual design of aircraft

BENEFITS TO NASA

R&D	Company testing of analysis is critical to developing a state-of-the-art design and analysis tool
Dollars Leveraged	(1) In 1990, NASA gained $167,500 worth paid of R&D* (2) In 1991, NASA will likely gain over $300,000 worth of R&D* * Does not include the value of in-kind contributions or of prior developed technology provided by university and members
Intellectual Property Gained	(1) Rapid development of new modules (2) NASA gains access to otherwise unobtainable company data
Successful Tech Transfer & Commercialization	(1) Technology moved into/out of NASA (2) "Time-to-Commercialization": companies already integrating ACSYNT into business operations (3) ACSYNT already a major contribution to the creation of uniform standard for conceptual design & analysis of aircraft

III. Projects Under Development

1. Air Pressure Measurement Surface Coatings (3 Years)

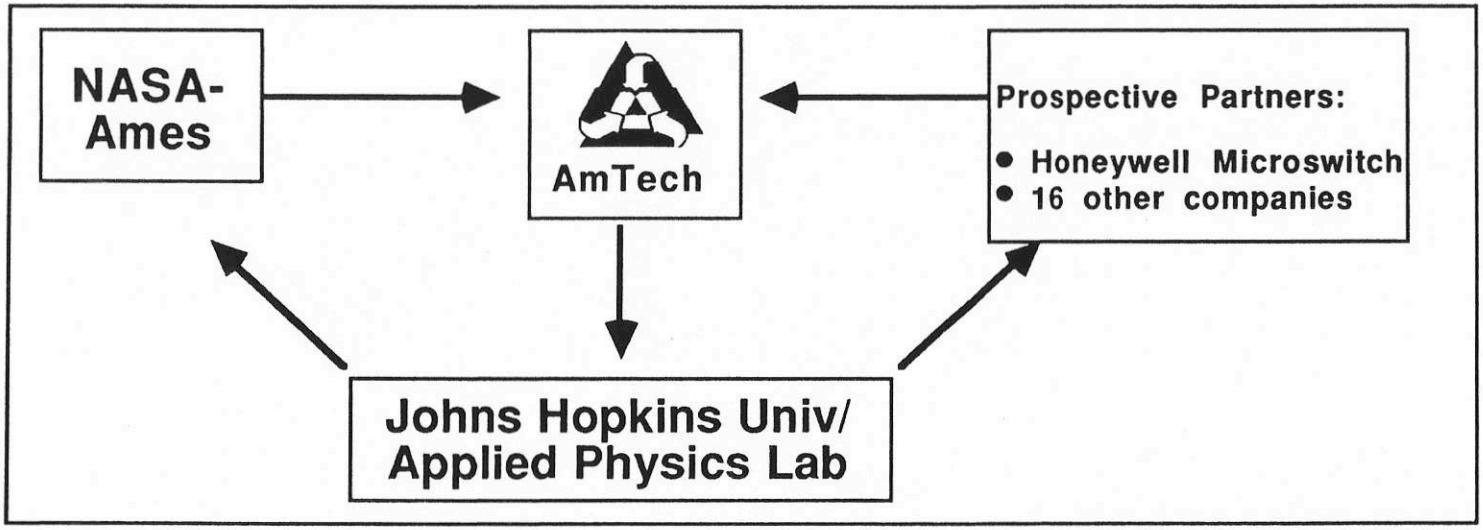


Research	Coating on wind tunnel test models to measure air pressure variations	
Participants	NASA-ARC, 4 aerospace companies, U. Wash. (Seattle)	
Resource Commitments (3 years)	NASA	$150,000 + in-kind resources
	Industry	$500,000 + in-kind resources
	U. Washington	Prior medical application/research

1. Air Pressure Measurement Surface Coatings (cont'd):

PROPERTY RIGHTS	NASA	Unlimited research usage, no further cost
	INDUSTRY	First access to results for internal use
COMMERCIAL VALUE	Companies will reduce wind tunnel test costs, and increase range and type of tests with reliable measures Potential application to automobile industry	
NASA BENEFITS	Estimated "$" leverage: 6 to 1 Wider and faster distribution of research Securing possible NASA co-ownership in technology	

2. Collision Avoidance Sensors (3 Years)

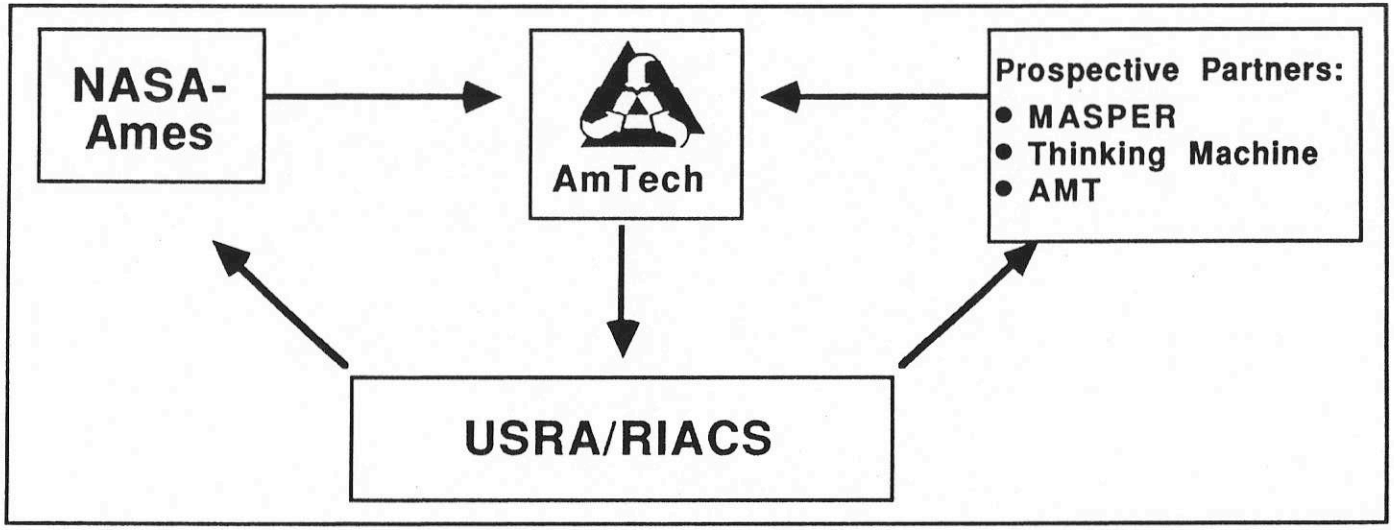


Research	Capacitive Sensors with 5 times the range of current sensors, applied to FTS Robot skin	
Participants	NASA-GSFC, Johns Hopkins/APL, sensor manufacturer	
Resource Commitments (3 years)	NASA	$300,000 + in-kind resources
	Industry	$300,000 + in-kind resources

2. Collision Avoidance Sensors (cont'd)

PROPERTY RIGHTS	NASA	Unlimited research usage, no further cost
	INDUSTRY	Exclusive commercialization rights, with a 3 year march-in rights
COMMERCIAL VALUE	Company will manufacture and sell advanced capacitive sensors to replace current limited range sensors	
NASA BENEFITS	Estimated "$" leverage: 1 to 1 Accelerated rate of delivering sensors for mission integration Access to private sector expertise for durability, mounting, and maintenance	

3. Parallel Processing Programming Software (3 years)



Research	**Portable linear algebra programming software for SIMD-DPS computers**	
Participants	**NASA-ARC, 3 computer companies, USRA/RIACS**	
Resource Commitments (3 years)	**NASA**	**$330,000 + in-kind resources**
	Industry	**$480,000 + in-kind resources**

3. Parallel Processing Programming Software (cont'd):

PROPERTY RIGHTS	NASA	Unlimited research usage, no further cost
	INDUSTRY	First access to results; software distribution with hardware
COMMERCIAL VALUE	Companies will distribute the software to encourage use of their hardware, leading to additional computer sales	
NASA BENEFITS	Estimated "$" leverage: 1.5 to 1 Lower cost of CFD applications development Scientific exchange will increase through portability of the software	

Summary of Projects in Early Development Stages

Project Stages	R&D Program/Technology Areas: SEI / Life Support	HPCI	SSF	Aeronautics
Screening				• Grid Generation
#1 R&D Proposal	• Water Purification • Ambulatory Monitor		• Fault Tolerant Systems	• Deicing Fluid
#2 Intellectual Property		• Parallel Processing	• Robotic Sensor	• Surface Coatings
#3 Commercial Commitment				
#4 Legal Agreements				

IV. Infrastructure Development is an Integral Part of Effort

1. Policies and Procedures for Quality Control

- Four step project development process with clear go/no-go decision points:
  - R&D Proposal
  - Intellectual Property Rights
  - Commercialization Commitment
  - Legal Agreements
- JSR Program policies tailored from analysis of NASA R&D research needs and technology exchange goals
- System of creating, reviewing, and updating procedures to:
  - Increase efficiency of JSR project development
  - Meet needs and requests of NASA research managers

2. Human Resources in Different Specialties

- **Staff** — Corporate, government, scientific, financial and legal experience
- **Trustees** — Access to industry, academic and policy research sources
- **Pro-Bono** — Industrial research, technology exchange, commercialization and law

3. Coordination With NASA Programs and Centers

- Regular NASA briefings
- Liaisons at each Center
- Monthly exchange of possible joint research projects with TU staff (currently limited to Ames)
- Identification and accumulation of databases on common NASA-Industry technology development interests, needs and plans

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From Financial Perspective, The JSR Program Is Attractive

Project Status	R&D Focus	NASA * Funds	Non-NASA * Funds	Leverage * (Non-NASA $/ NASA $)
Implemented	• Space Born Mass Spectrometer (2 yr)	$359,163	$269,500	.75 + (in-kind)
	• ACSYNT-Software Development (5 yr)	$500,000	$1,500,000	3.0 + (in-kind)
Under Development	• Air Pressure Measurement (3 yr)	$150,000	$500,000	2.3 + (in-kind)
	• Collision Avoidance Sensors (3 yr)	$300,000	$300,000	1.0 + (in-kind)
Immediate Future Prospects	• Parallel Processing Software (3 yr)	$330,000	$480,000	1.4 + (in-kind)
	• Water Purification (5 yr)	$2,200,000	$2,800,000	1.2 + (in-kind)
	• Grid Generation (3 yr)	$150,000	$600,000	4.0 + (in-kind)
	• Ambulatory Monitor (3 yr)	$300,000	$300,000	1.0 + (in-kind)
	TOTALS	$4,289,163	$6,749,500	1.6 + (in-kind)

* Actual & Estimates

The JSR Program Provides Benefits to NASA:

- **Expand R&D Resources**
  - * pay as little as $.50 for each $1.00 spent to achieve NASA R&D goals
  - * pursue additional important research efforts by leveraging limited NASA resources
  - * build strong research teams through "in-kind" relationships with private sector researchers
  - * accelerate R&D accomplishments through two-way technology exchange
- **Enhance R&D Management**
  - * establish joint R&D objectives and plans through early/direct private sector involvement
  - * retain control over every aspect of NASA's involvement in joint R&D projects
  - * co-direct academia to achieve agreed R&D milestones
  - * obtain assistance in facilitating joint R&D projects
- **Accomplish Important Agency Goals**
  - * enrich educational opportunities by bringing challenging technical/commercial projects to universities
  - * enhance U.S. competitiveness by accelerating the "time-to-commercialization"
  - * strengthen private sector role in technology development
    - — build business/technology network with non-NASA contractors
    - — improve access to NASA for medium and small businesses
    - — foster private sector participation in NASA's R&D programs

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- **Summary**

AmTech was Created to be the Special "Bridge" Organization Necessary to Successfully Implement the JSR Program

- Independently chartered as a catalyst for change: synergistic, complementary, and non-competitive to both public and private sectors
- Operates as not-for-profit entity, with private sector efficiencies, in "partnership" with its sponsors
- Exists in public interest to advance and contribute to U.S. economic competitiveness
  - research, innovation, and implementation of market-driven public-private R&D collaboration
  - net revenues donated to advancement of aerospace education and research
- Charter fosters trust and confidence
  - trustees are respected public service leaders
  - OPM certification to host federal employees on loan
  - open to scrutiny and audit by its sponsors
  - provides neutral "playing field" for public-private sector collaboration
- Staffed with critical business, finance, technology, and legal expertise, uniquely qualified to meet JSR Program needs

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Action Requested

Associate Administrator for OAET:

- **Grant permission to move forward with projects currently under development:**
  - **Air Pressure Measurement Surface Coatings**
  - **Collision Avoidance Sensors**
- **Recommend to the Administrator to:**
  - **authorize the use and delegation of funded Space Act authority (NMI)**
  - **approve an agreement for a long term NASA commitment to JSR Program (MOU)**
- **Foster NASA management attitude and environment to support the JSR Program, and establish expedient project approval process**

The JSR Program is Aligned with Emerging NASA Initiatives and Roles

- NASA Administrator has established a Commercial Space Steering Group and launched a new Space Commerce Opportunities Initiative
- NASA is an important member of OSTP/FCCSET Committee on Technology and Industry
- National Space Council's Space Policy Implementation draft guidelines recommend JSR Program
- Augustine Committee recommends that Administrator be member of President's Council on Competitiveness

Management Philosophy

"Our goal is to stimulate the involvement and investment of U.S. industry in space -- non-aerospace industry and the newer entrepreneurial firms interested in space endeavors as well as the traditional aerospace industry sector.

NASA, as it develops new technology, must ensure that this technology is transferred to the private sector. The taxpayers' investment in NASA is an investment in the international competitiveness of U.S. industry."

Richard H. Truly
NASA Administrator
August 20, 1990

Technology Policy

"The most effective means of transferring technology is through person-to-person contact. This requires greater mobility of both government and private sector personnel. But this mobility will only result from a desire on the part of all parties to work together on common problems."

Committee on Science, Space and Technology
U.S. House of Representatives
"Technology Policy and Its Effect on
The National Economy," October, 1988

U. S. Commercial Space Policy Implementation
Draft Guidelines

U.S. Government agencies shall promote the transfer of U.S. Government-developed technology to the private sector

- U.S. Government-developed space technology will be transferred to the U. S. commercial space sector in as timely a manner as possible and in a manner that protects its commercial value

- U.S. Government agencies may undertake cooperative research and development activities with private sector, as well as state and local governments, consistent with policies and funding, in order to fulfill mission requirements in a manner which encourages the creation of commercial opportunities

Mark J. Albrecht
Executive Secretary
National Space Council
December 19, 1990